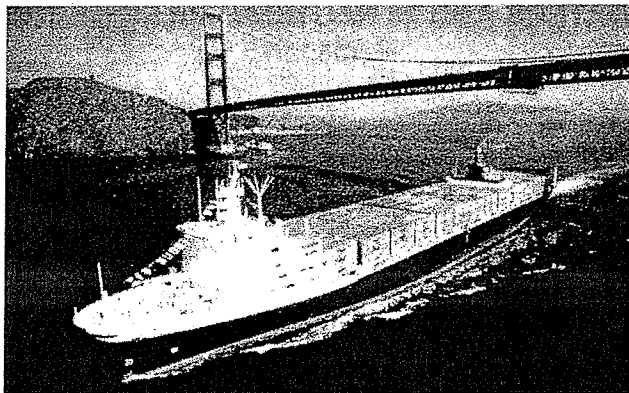




STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING



PROPOSED REGULATION FOR AUXILIARY DIESEL ENGINES AND DIESEL-ELECTRIC ENGINES OPERATED ON OCEAN-GOING VESSELS WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE

**Stationary Source Division
Emissions Assessment Branch
October 2005**

**State of California
AIR RESOURCES BOARD**

**STAFF REPORT: INITIAL STATEMENT OF REASONS
FOR PROPOSED RULEMAKING**

Public Hearing to Consider

**PROPOSED REGULATION FOR AUXILIARY DIESEL ENGINES AND DIESEL-
ELECTRIC ENGINES OPERATED ON OCEAN-GOING VESSELS WITHIN
CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA
BASELINE**

To be considered by the Air Resources Board on December 8-9, 2005, at:

California Environmental Protection Agency
Headquarters Building
1001 "I" Street
Byron Sher Auditorium
Sacramento, California

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**State of California
AIR RESOURCES BOARD**

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CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA
BASELINE**

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Acknowledgements

This report was prepared with the assistance and support from the other divisions and offices of the Air Resources Board. In addition, we would like to acknowledge the assistance and cooperation that we have received from many individuals and organizations.

**Staff Report: Initial Statement of Reasons for Proposed Rulemaking
Proposed Regulation for Auxiliary Diesel Engines and Diesel-Electric Engines
Operated on Ocean-going Vessels within California Waters and
24 Nautical Miles of the California Baseline**

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EXECUTIVE SUMMARY

Air pollution from maritime port activities is a significant and growing concern in California. Diesel-powered vehicles and engines at the ports emit soot, or diesel particulate matter (PM), and other air pollutants that can increase health risks to nearby residents. Port operations are also a significant source of oxides of nitrogen (NOx) which can contribute to the formation of regional smog, or ozone, and fine particulate matter.

Living in any area impacted by air pollution is harmful, particularly for children, the elderly, and those with compromised health. The communities closest to port operations face even greater impacts and have a greater localized risk due to exposures to high levels of diesel PM. This pollutant poses a lung cancer hazard for humans, and causes non-cancer respiratory and cardiovascular effects that increase the risk of premature death. In addition, in many cases, the populations nearby ports are economically disadvantaged and less able to obtain quality health care to address air pollution-related illnesses.

Unless substantial additional control measures are implemented, port-related emissions are expected to significantly increase as trade grows over the next 15 to 20 years. While the movement of goods through California ports is a vital component of the State's overall economy and provides a key link to international trade, it is essential that aggressive steps be taken to counter the projected emissions increases and ensure that the port-related emissions are reduced to health protective levels.

As one of several steps being taken to reduce emissions from port activities, the Air Resources Board (ARB) staff is proposing a regulation to reduce emissions from ocean-going vessel auxiliary engines. Implementation of this regulation will be an important and necessary step in the effort to improve the public health in communities near ports. A recent ARB study has shown that diesel PM emissions from hotelling (auxiliary engine emissions while vessels are moored) are the largest contributor of toxic pollutants to neighboring communities. The proposed regulation would reduce the emissions of diesel PM, NOx, sulfur oxides (SOx), and "secondarily" formed PM (PM formed in the atmosphere from NOx and SOx). The proposed regulation will reduce emissions from ocean-going vessel auxiliary engines through the use of cleaner marine distillate fuels, or equally effective alternative controls. This would result in immediate, substantial reductions in emissions upon implementation in 2007. Specifically, for the nearly 80 percent of vessels currently using heavy fuel oil in their auxiliary engines, compliance with the proposed regulation will result in an estimated 75 percent reduction in diesel PM, 80 percent reduction in SOx, and 6 percent reduction in NOx.

This proposed regulation is one of several measures currently under consideration that will continue progress in meeting the air quality goals defined in the Diesel Risk Reduction Plan and the State Implementation Plan and that will help offset the projected emissions increases in port-related emissions. Other regulations being proposed include measures to reduce emissions from cargo handling equipment, commercial

harbor craft, and off-road diesel engines. ARB staff is also pursuing additional air pollution control strategies for ocean-going vessels in the coming years, including addressing the main engines on ocean-going vessels, and exploring emission reduction options for vessels that make frequent port visits.

Presented below is an overview which briefly discusses the information presented in this document. For simplicity, the discussion is presented in question-and-answer format. It should be noted that this summary provides only brief discussions of the topics. The reader is directed to subsequent chapters in the main body of the report for more detailed information.

1. What is ARB proposing?

The proposed regulation requires that auxiliary engines on vessels operating within 24 nautical miles (nm) of the California coastline significantly reduce their diesel PM, NOx, and SOx emissions. Emission reductions can be achieved by using cleaner-burning marine distillate fuels, or implementing equally effective alternative emission control strategies under an "Alternative Compliance Plan (ACP)." For vessels complying with the fuel requirement, vessel operators will need to switch from the use of heavy fuel oil to marine distillate fuel while they are in port and while they are operating within 24 nm of the California coastline, unless they already use complying distillate fuels or choose to use distillate fuels on a permanent basis. If operators choose to comply with the proposed regulation under an ACP, they must demonstrate that the alternative emission control strategies will result in no greater emissions relative to the emissions that would have occurred by complying with the fuel requirements. The proposed regulation will apply to both U.S.-flagged and foreign-flagged vessels.

2. Does ARB have the authority to regulate the emissions from ocean-going vessels as specified in the proposal?

Yes, under State and federal law, ARB can regulate both criteria pollutants and toxic diesel PM emissions from marine vessels. Health and Safety Code (H&SC) sections 43013 and 43018 authorize ARB to regulate marine vessels to the extent such regulation is not preempted by federal law. Also, H&SC § 39666 requires ARB to regulate emissions of toxic air contaminants (TAC) from nonvehicular sources, which include ocean-going vessels. The proposed regulation reduces or limits emissions of diesel PM, which is both a TAC and criteria pollutant, and NOx and SOx, which are both criteria pollutants.

The proposed regulation is neither preempted under federal law, nor does it violate the Commerce Clause. Federal authorization under section 209(e) of the Clean Air Act (CAA) is required for regulating new nonroad engines and for requiring retrofits on existing engines. Ocean-going vessel engines, by definition, fall within the category of nonroad engines. However, no federal authorization is required for implementing in-use operational requirements on existing marine vessels and their engines. The proposed regulation is an in-use operational requirement because it does not apply to the

manufacturing process for an engine (i.e., new engine certifications), but only to the emissions of engines installed on ocean-going vessels that operate in California waters.

Further, the proposed regulation does not conflict with the Ports and Waterways Safety Act (PWSA) and U.S. Coast Guard regulations. As an even-handed regulation with substantial benefits, the proposed regulation does not violate the Commerce Clause. And federal and state cases support our authority to regulate both U.S. and foreign-flag vessels within California waters. Therefore, federal law neither preempts the proposed regulation, nor does the regulation violate the requirements of the Commerce Clause.

3. Why is ARB proposing statewide implementation of this regulation rather than having the districts adopt regulations?

We are proposing statewide, uniform implementation of this regulation, rather than encouraging district-by-district adoption of different regulations, for practical reasons as well as ensuring that California speaks with "one voice" with regard to regulating foreign-flag vessels. Under H&SC § 43013 and 43018, ARB and the districts share concurrent jurisdiction over marine vessels, which are considered to be nonvehicular sources. In addition, H&SC § 39666(d) requires the districts to implement and enforce an ARB airborne toxic control measure (ATCM) or adopt and enforce an equally effective or more stringent ATCM. Thus, the districts are authorized to regulate the auxiliary diesel engines on vessels, and each district can do so provided its regulations are equally effective or more stringent.

The districts' authority notwithstanding, we believe it is prudent for the districts to coordinate their efforts with those of ARB and have ARB take the lead role in implementing the ATCM. We believe this for several reasons. First, it is impractical for many districts to enforce an ATCM against ocean-going vessels, many of which make multiple visits to ports throughout California. Second, ARB has gained technical expertise over several years of developing this regulation, which would require a significant expenditure of district resources to replicate. Third, the districts are permitted but not required to adopt and enforce an equally effective or more stringent ATCM. By coordinating their efforts with ARB and having ARB take the primary lead in implementing the ATCM statewide, the districts will have met their statutory obligations under H&SC § 39666(d).

Equally important to the practical concerns are the international foreign commerce concerns. Under the dormant Foreign Commerce Clause, regulations that interfere with a nation's ability to "speak with one voice when regulating commercial relations with foreign governments," may be held invalid. Having a patchwork of district regulations different from ARB's proposal, may frustrate the efficient execution of the nation's foreign policy to speak with one voice. Thus, it would be in California's best interests to coordinate statewide efforts so that foreign-flag and U.S.-flag vessels visiting California ports only need to understand and meet one set of statewide regulations.

4. What is an ocean-going vessel?

Ocean-going vessels are generally very large vessels designed for deep water navigation. Ocean-going vessels include large cargo vessels such as container vessels, tankers, bulk carriers, and car carriers, as well as passenger cruise vessels. These vessels transport containerized cargo; bulk items such as vehicles, cement, and coke; liquids such as oil and petrochemicals; and passengers.

Ocean-going vessels travel internationally and may be registered by the U.S. Coast Guard (U.S.-flagged), or under the flag of another country (foreign-flagged). The majority of vessels that visit California ports are foreign-flagged vessels.

5. What is an auxiliary engine?

Auxiliary engines are diesel engines on ocean-going vessels that provide power for uses other than propulsion (except as noted below for diesel-electric vessels). Auxiliary engines are usually coupled to generators used to produce electrical power. On cargo vessels, most auxiliary engines are used to provide ship-board electricity for lighting, navigation equipment, refrigeration of cargo, and other equipment. Typically, a cargo vessel will have a single, very large main engine used for propulsion, and several smaller auxiliary "generator-set" engines.

Passenger cruise vessels, and some tankers, use a different engine configuration which is referred to as "diesel-electric." These vessels use large diesel generator sets to provide electrical power for both propulsion and ship-board electricity. For the purposes of the proposed regulation, these large diesel generator sets are included in the definition of "auxiliary engines."

6. What fuels do ocean-going vessel operators use in auxiliary engines?

Most vessel operators use either heavy fuel oil (HFO or residual fuel) or marine distillate fuels in their auxiliary engines. HFO is a very viscous fuel that must be heated to allow it to flow through piping and be combusted in auxiliary engines. HFO is often referred to as residual fuel or bunker fuel. This fuel has high levels of sulfur, ash, and nitrogen containing compounds, and results in much higher emissions than the use of marine distillate fuels. Marine distillate fuels include marine gas oil (MGO) and marine diesel oil (MDO). These distillate fuels are similar to the diesel fuel used by landside sources. According to an ARB survey of vessels visiting California ports, about 75 percent of auxiliary engines use HFO and about 25 percent use marine distillate fuels.

7. What emissions result from the auxiliary engines used on ocean-going vessels?

Estimates of the statewide 2004 emissions of diesel PM, NO_x, hydrocarbons (HC), and SO_x, from ocean-going vessel auxiliary engines are presented in Table ES-1 below.

These emissions estimates include emissions that occur within 100 nm or less off California's coast, emissions that occur in California inland waters such as emissions from vessels transiting to the ports of Stockton and Sacramento, and emissions that occur while vessels are in-port. The "boundary" of 100 nm was selected because it can be distinguished with relative ease and it is inclusive of the major areas of activity of the sources of interest.

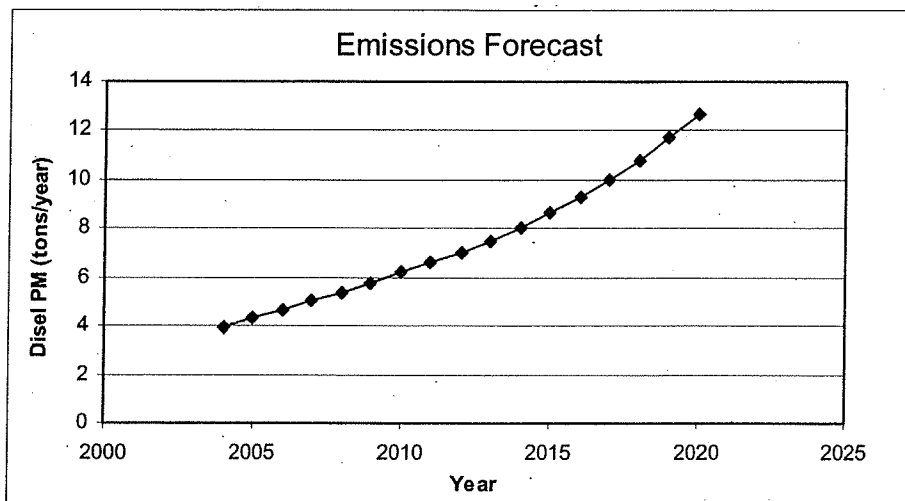
**Table ES-1: 2004 Emissions from Ocean-going Vessel
Auxiliary Engines in California**

Vessel Types	Number of Vessels	Numbers of Vessel Visits	2004 Pollutant Emissions, Tons/Day				
			NOx	HC	CO	PM	SOx
Auto	225	750	1.11	0.03	0.08	0.10	0.71
Bulk	475	946	4.02	0.11	0.30	0.35	2.55
Container	594	4744	18.11	0.50	1.37	1.57	11.48
General	196	721	1.75	0.05	0.13	0.15	1.11
Passenger	44	687	14.44	0.39	1.09	1.39	10.24
Reefer	19	52	0.60	0.02	0.05	0.05	0.38
RoRo	13	34	0.40	0.01	0.03	0.03	0.25
Tanker	372	1941	3.16	0.09	0.24	0.27	2.00
Totals	1938	9875	43.6	1.20	3.29	3.91	28.7

As shown in Table ES-1, there are approximately 1,900 ocean-going vessels that visited California's ports in 2004, and these vessels made nearly 10,000 port calls. Of those 1,900 vessels that visited California's ports, 30 percent were container vessels, and these vessels represented more than 45 percent of the vessel visits to California's ports.

The emissions from ocean-going vessels are projected to grow significantly over time as trade continues to increase. The projected diesel PM emission estimates up to 2020 are presented in Figure ES-1.

Figure ES-1: Ocean-going Vessel Auxiliary Engine Diesel PM Emissions Estimates Projected to Year 2020



8. What are the exposures and potential health risks from ocean-going vessel auxiliary engine emissions?

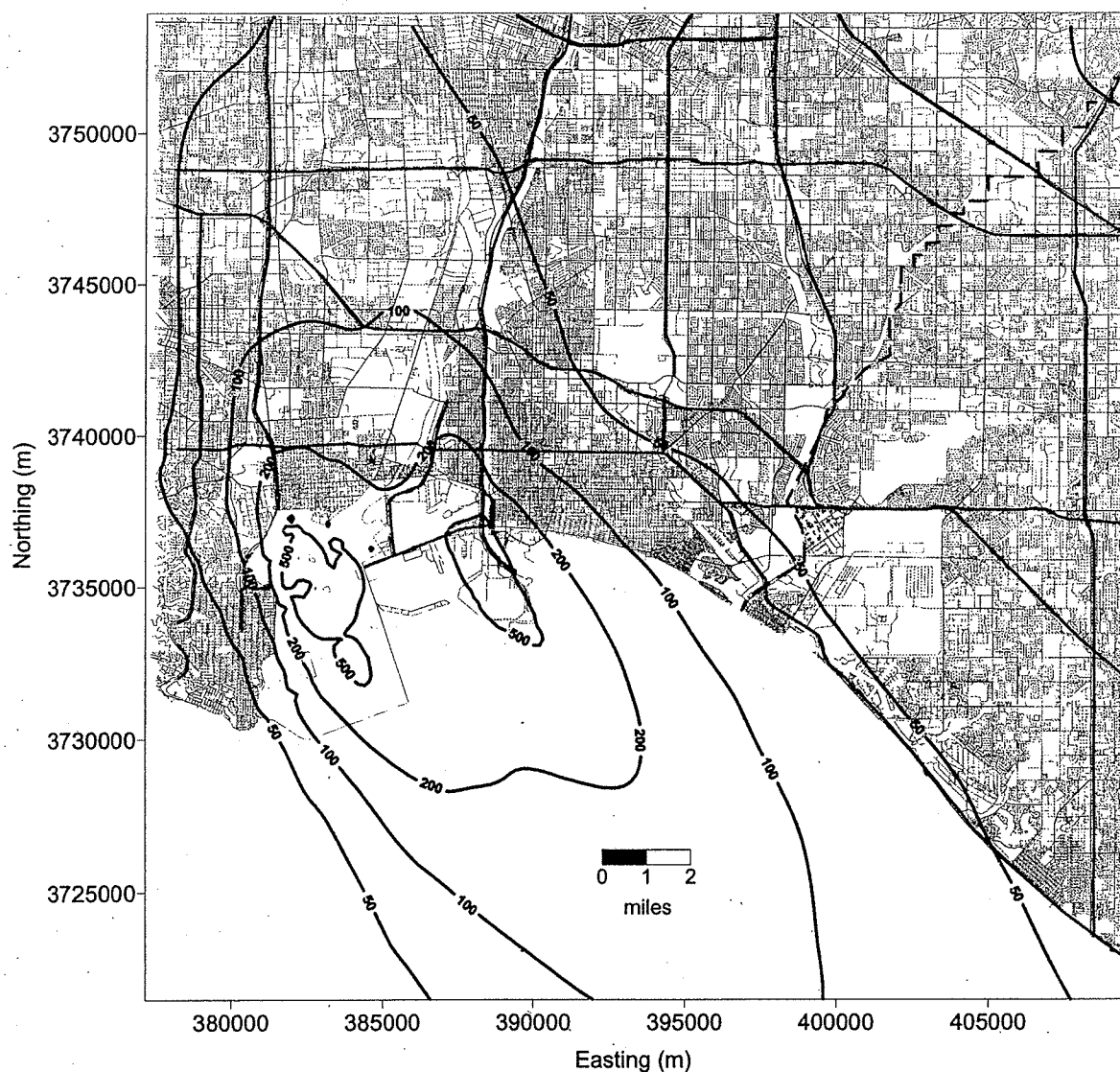
The majority of California's ports are in urban areas and, in most cases, are located near where people live, work, and go to school. This results in substantial exposures to diesel PM emissions from the operation of vessel auxiliary engines in California. Exposures to these emissions can result in increased cancer risk and non-cancer health impacts, such as premature death, irritation to the eyes and lungs, allergic reactions in the lungs, and asthma exacerbation.

Because analytical tools to distinguish between ambient diesel PM emissions from vessel auxiliary engines and that from other sources of diesel PM do not exist, we cannot measure the actual exposures to emissions from auxiliary engines. However, modeling tools can be used to estimate potential exposures. To investigate the potential risks from exposures to the emissions from auxiliary engines, ARB staff used dispersion modeling to estimate the ambient concentration of diesel PM that results from the operation of ocean-going vessel auxiliary engines that visit the Port of Los Angeles (POLA) and the Port of Long Beach (POLB). The study area was a 20-mile by 20-mile grid centered on POLA and POLB.

The activities of vessel auxiliary engines resulted in significant cancer risk and other PM related health impacts on the nearby residential areas. Figure ES-2 shows the estimated cancer risk isopleths for diesel PM emissions from vessel auxiliary engines (during transiting, maneuvering, and hotelling) at the Ports of Los Angeles and Long Beach superimposed on a map that covers the ports and the nearby communities.

ARB estimated the area in which the cancer risks are predicted to exceed 100 in a million to be about 13,500 acres with an exposed population of about 225,000. For the cancer risk level over 200 in a million, the impacted area is estimated to be about 2,260 acres, with an exposed population of about 48,000 people. Overall, about 99.5 percent of the study area (excluding port property and the surrounding ocean area) has an estimated cancer risk level of over 10 in a million due to auxiliary engine emissions. We estimate that about 2 million people live in the study area. ARB staff believes that the results from this analysis provide quantitative results for exposures around the Ports of Los Angeles and Long Beach and indicate that elevated risks also occur at other ports in California.

Figure ES-2: Estimated Diesel PM Cancer Risk from Vessel Auxiliary Engine Activity at POLA and POLB (Wilmington Met Data, Urban Dispersion Coefficients, 80th Percentile Breathing Rate, Emission = 405 TPY, Modeling Receptor Domain = 20 mi x 20 mi, Resolution = 200 m x 200 m)



ARB staff also estimated the potential non-cancer impacts associated with exposure to diesel PM from ocean-going vessel auxiliary engines. The non-cancer health effects evaluated include premature death, asthma attacks, work loss days, and minor restricted activity days due to diesel PM emissions from auxiliary engines. Based on the analysis, staff estimates that the average number of cases statewide per year that would be expected from exposure to the 2004 ocean-going vessel diesel PM emission levels are as follows:

- 31 premature deaths (for ages 30 and older), 16 to 48 deaths as 95% confidence interval (CI);
- 830 asthma attacks, 202 to 1,457 as 95% CI;
- 7,258 days of work loss (for ages 18-65), 6,143 to 8,370 as 95% CI;
- 38,526 minor restricted activity days (for ages 18-65), 31,403 to 45,642 as 95% CI.

9. What does the proposed regulation require?

Under the proposed regulation, vessel operators are required to reduce diesel PM, NOx and SOx emissions to levels equivalent to the emissions levels that would occur if cleaner-burning distillate fuels were used. To meet this requirement, we expect that most vessel operators will elect to use the distillate fuels specified in the proposal. However, some may decide to implement an alternative emission control strategy that would achieve equivalent or greater emission reductions. Specifically, under the proposal, starting on January 1, 2007, vessel operators can comply by using one of the following distillate fuels when operating their auxiliary engines within 24 nm of the California Coastline: (1) marine gas oil (MGO); or (2) marine diesel oil (MDO) with less than or equal to 0.5 percent by weight sulfur. A 0.5 percent sulfur limit is specified for MDO because it tends to have a higher sulfur level than MGO. MGO is expected to average at or below 0.5 percent sulfur in California based on the results of a survey sent to vessel operators in 2005.

Starting on January 1, 2010, marine gas oil meeting a 0.1 percent sulfur limit is specified under the proposed regulation. This lower sulfur fuel will result in additional emission reductions of PM and SOx, compared to the January 1, 2007 requirement. This standard is consistent with a recently adopted European Union regulation. However, a feasibility analysis is required under the proposed regulation prior to implementation of this fuel requirement to investigate the supply, cost, and technical feasibility of using this fuel. Based on the results of this evaluation, modifications to this requirement could be proposed to the Board.

While ARB has the authority to regulate ocean-going vessel emissions, we recognize that uniform national or international regulation of vessel emissions would be preferable to most vessel operators. As such, we have included a provision in the staff's proposal that requires the Executive Officer to propose terminating or modifying the requirements of this proposal to the Board if the United States Environmental Protection Agency

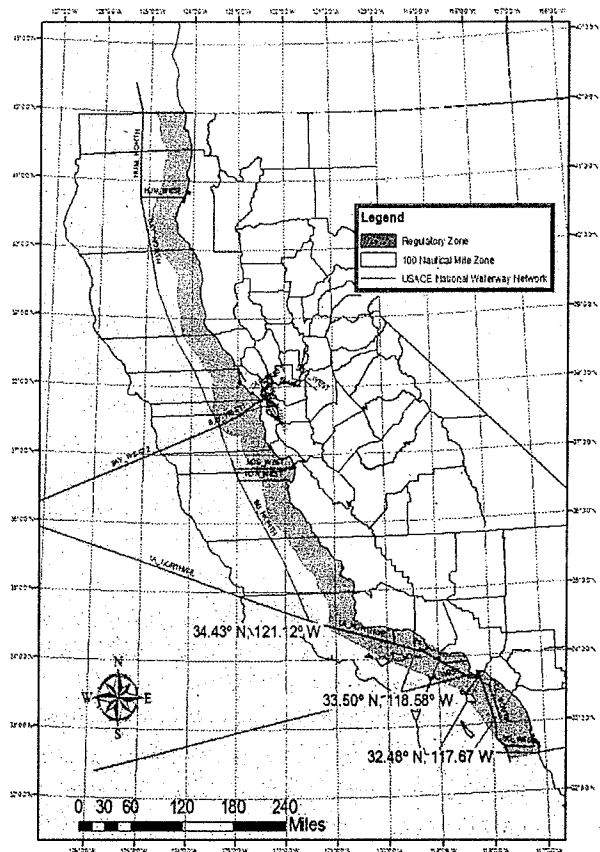
(U.S. EPA) or the International Maritime Organization adopts regulations that will achieve equivalent or greater emission reductions from vessels.

The proposed regulation does not address emissions from main engines (except for diesel-electric vessels), boilers, gas or steam turbine engines, or auxiliary engines on military vessels, which are exempted from the requirements of the proposed regulation. ARB staff plan to address main engines and other sources not regulated in this proposed rulemaking in the next couple of years.

10. How far offshore are ocean-going vessels required to comply with the proposed regulation?

Under the proposed regulation, vessel emissions would be regulated up to 24 nm off the California coastline. ARB has the authority to require emission reductions out to the California Coastal Water (CCW) boundary. This is the region within which emissions are likely to be transported onshore, and it extends beyond the 24 nm boundary. However, the 24 nm boundary which is shown as the gray area in Figure ES-3 was proposed because it significantly lowers the cost of the regulation while still providing the vast majority of the potential on-shore benefits in terms of reduced exposure to diesel PM. Specifically, about 75 percent of the auxiliary engine diesel PM emissions within 100 nm of the California coastline is emitted within the 24 nm boundary. The 24 nm boundary is also easily defined for vessel operators. The boundary is aligned in Central and Northern California with the outer boundary of the Contiguous Zone, an internationally recognized boundary which extends 24 nm offshore and is noted on most nautical charts. In Southern California, the boundary consists of straight line segments approximately 24 nm offshore of the coastline. This approximation is used because the outer edge of the Contiguous Zone extends around the Channel Islands, bringing the boundary well beyond 24 nm, and in some cases beyond the California Coastal Waters boundary.

Figure ES-3: Offshore 24 Nautical Mile Boundary for Proposed Regulation



11. Are the fuels specified in the proposed regulation available?

Yes. It is important that these fuels be available at ports worldwide because vessel operators seeking to comply with the proposed regulation through the use of these fuels will need to use them upon entering the 24 nm boundary off California's coastline. The fuels specified for January 1, 2007, are MGO, and MDO at or below 0.5 percent sulfur. MGO is widely available at ports worldwide since it is already used by harbor craft and many auxiliary engines on ocean-going vessels. We are not proposing a sulfur limit for MGO at this time because some ports only have higher sulfur MGO available. Because the proposed regulation has an initial compliance date of January 1, 2007, ARB staff had concerns that there would not be sufficient time or incentive for fuel refiners and suppliers worldwide to make fuel meeting a specified sulfur limit available at all bunkering ports. However, we expect the sulfur content of the MGO used by vessels visiting California ports to average at or below 0.5 percent sulfur, based on the results of an ARB survey and data on historical trends in sulfur content for these fuels. To provide additional flexibility to vessel operators, we are also allowing the use of MDO. This fuel tends to have a higher sulfur content than MGO, so we are limiting this fuel to 0.5 percent sulfur. Vessel owners can choose between using MDO that meets the sulfur limits or MGO.

Beginning January 1, 2010, MGO meeting a 0.1 percent sulfur limit is specified under the proposed regulation. While this fuel is not currently available at all ports worldwide, we believe it will become much more widely available by 2010, when a European Union directive requires the use of MGO meeting a 0.1 percent sulfur limit. In addition, to ensure this requirement of the proposed regulation can be implemented, ARB staff is proposing that an evaluation be conducted prior to 2010 to investigate the availability of 0.1 percent sulfur MGO at bunkering ports worldwide.

12. Will ocean-going vessels need to make modifications to the use the specified fuels?

According to a survey conducted by ARB staff, we expect that about 10 percent of the ocean-going vessels visiting California ports will require some type of modification to use the fuels specified in the proposed regulation. The modifications needed are vessel-specific, and may include:

- expanding fuel storage capacity for distillate fuel;
- adding piping, instrumentation, valves, and vents;
- adding fuel processing equipment (settling tanks, filters, etc.); and/or
- modifying fuel pumps and fuel injectors.

The proposed regulation has provisions to provide additional time (up to five years to make vessel modifications) and flexibility to operators of these vessels (see item 14 below).

13. Is the proposal technically feasible?

Yes. Based upon ARB staff's analysis and discussions with numerous stakeholders, including the engine manufacturers, staff believes that the requirements of the proposed regulation are technically feasible. Under the proposal, vessel operators may comply by using cleaner-burning marine distillate fuels in their auxiliary engines instead of heavy fuel oils, or implementing alternative emission control strategies. For vessel operators that comply through the use of cleaner-burning fuels, they will need to ensure that they are using marine distillate fuels prior to entering the 24 nm boundary. ARB staff found that vessel operators already switch to marine distillate fuels prior to certain scheduled maintenance operations, and many also routinely switch to these fuels for air quality reasons in California. Discussions with the manufacturers also indicated that these engines can operate on marine distillate fuels provided certain precautions are followed, such as performing fuel switches according to recommended procedures. Beginning January 1, 2010, the proposal specifies a lower 0.1 percent sulfur marine distillate fuel. This standard will be subject to a feasibility evaluation prior to implementation to fully investigate the availability of this fuel and if any technical issues exist.

14. What key provisions are included in the proposed regulation to provide flexibility?

The proposed regulation includes two provisions providing compliance flexibility. These provisions are summarized below.

Alternative Control Plan

The alternative compliance plan (ACP) was included in the proposed regulation to provide vessel owner/operators with the flexibility to implement alternative emission control strategies that result in no greater emissions compared to the use of the fuels specified in the proposal. Alternative emission control strategies may include the use of shore-side electrical power, engine modifications, exhaust treatment devices such as diesel oxidation catalysts, and the use of alternative fuels or fuel additives. ACP plans may apply to a single vessel, or a fleet of vessels under the direct control of the applicant for an ACP.

There is also a specific provision that applies to vessels that shut off their diesel auxiliary engines and connect to shore-side power. Under this provision, emissions from auxiliary engines will be considered to meet the emission reduction requirements of the proposed regulation: (1) during travel from a previous port to a California port where shore-side power is used; (2) while docked and utilizing shore power; and (3) during travel to a subsequent port. This provision is designed to encourage the expanded use of shoreside power, which achieves greater emission reductions closest to nearby communities.

Noncompliance Fee Provision

This provision provides vessel operators with the flexibility to pay a fee in lieu of compliance in certain limited circumstances. The funds collected under this provision would be used to substantially reduce emissions from: (1) port sources; (2) sources within 2 miles of port boundaries; or (3) oceangoing vessels within "Regulated California Waters." Under this program, the fee is designed to ensure that participants will not be provided an economic advantage compared to vessel operators complying with the regulation. The fee schedule is graduated such that subsequent visits would result in increasing fees.

This option could only be used in the following circumstances:

- vessel is unexpectedly redirected to a California port;
- vessel was not able to acquire a sufficient quantity of compliant fuel at the last fueling port;
- fuel was found to be out of compliance after leaving the last bunkering port;
- modifications are required and the vessel operator is not able to complete the modifications in time to meet the January 1, 2007 requirements; and
- modifications are required and the vessel will visit a California port a maximum of two times per calendar year, and a four times over the life of the vessel after January 1, 2007.

15. How does the regulation affect diesel-electric vessels?

Diesel-electric vessels use large diesel generator sets to provide power for both propulsion and ship-board electricity. Passenger cruise vessels, and a few tankers, use this engine configuration. For the purposes of the proposed regulation, these large diesel generator sets are considered "auxiliary engines," and are covered by the proposed regulation. We are proposing to regulate these engines the same as other auxiliary engines because they are mechanically similar to the smaller auxiliary engines used on other vessels. Specifically, they are four-stroke, medium speed engines used in generator set applications. As such, these engines can meet the requirements of the proposed regulation. In fact, some diesel-electric cruise vessels currently use the distillate fuels specified in the proposed regulation near California ports.

16. How will ARB staff verify compliance with the proposed regulation?

Enforcement of the proposed regulation will be achieved through random inspections of records, and fuel sampling/testing. ARB staff will coordinate vessel inspections with inspections conducted by other State agencies such as the California State Lands Commission to the extent feasible. During vessel inspections, records will be reviewed to determine when vessels traveled within "Regulated California Waters" and the fuels used during this time. Records on the quantity of fuel purchased, the fuel type, and the sulfur content of the fuel will be reviewed to determine compliance. Fuel samples will

be analyzed to ensure that they meet the ISO specifications for the fuel type and do not exceed the sulfur content limits under ISO or the proposed regulation.

As a long term goal, ARB staff wants to transition from compliance data being recorded in logs maintained on the vessel, to automated electronic data devices that can store and transmit data needed to assess compliance. ARB staff plans to work with vessel owners and equipment suppliers to develop and field test data recording and submittal systems that can provide compliance data on a real-time basis.

17. What businesses and public agencies will be affected by the proposed regulation?

The proposed regulation would impact foreign and domestic businesses that own or operate large ocean-going vessels. This would include ocean shipping companies and passenger cruise vessel operators.

We do not expect significant impacts on “downstream” companies such as importers or exporters of goods, since the added costs imposed by the proposal are not expected to result in significant adverse impacts to vessel owners or operators. Similarly, we do not expect adverse impacts on California ports because we do not believe the added cost of the proposed regulation is great enough to induce vessel operators to divert cargos to ports outside California.

We do not predict any significant impact on public agencies. With the exception of military vessels, which are exempted from the requirements of the proposed regulation, public agencies in California generally do not operate ocean going vessels as defined in the proposal.

18. What are the health and environmental impacts of the proposed regulation?

Upon implementation in 2007, the proposed regulation will result in immediate and significant reductions in emissions of diesel PM, NO_x, SO_x, and “secondarily” formed particulate matter. Specifically, considering only the directly emitted emissions (not secondarily formed PM), the proposed regulation will result in estimated statewide emission reductions of 2.7 TPD of diesel PM, 1.9 TPD of NO_x, and 22 TPD of SO_x in 2007. For perspective, the proposal would result in an estimated 75 percent reduction in diesel PM, 80 percent reduction in SO_x, and a 6 percent reduction NO_x from an engine that previously used typical heavy fuel oil. Beginning in 2010, the 0.1 percent sulfur limit will result in an additional 10 percent reduction in diesel PM. The estimated reductions for diesel PM, NO_x and SO_x, as shown in Table ES-2, reflect the use of the cleaner marine distillate fuels specified in the proposed regulation, although alternative control technologies could also be used to achieve equivalent reductions. The estimates do not reflect participation in the “noncompliance fee provision” in the proposal that allow shippers to pay a fee in lieu of compliance because we cannot predict the rate of participation. However, we would expect that the use of

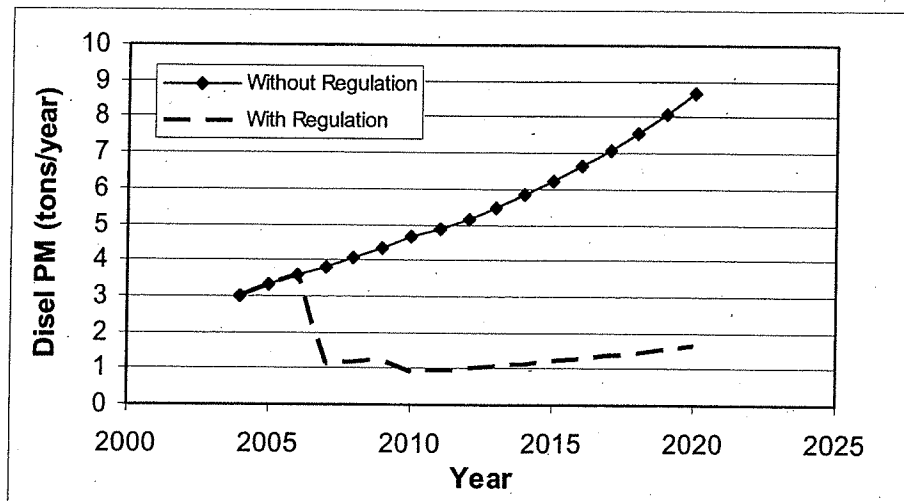
noncompliance fees would be very limited, and whatever fees that are generated would be used to achieve emission reduction around the ports.

Table ES-2: Estimated Emission Reductions from Implementation of the Proposed Regulation

Year	Auxiliary Engine Emission Reductions (Tons per Day)		
	PM	NOx	SOx
2007	2.7	1.9	22
2010	3.7	2.3	32
2015	5.0	3.2	43
2020	7.0	4.4	61

The emission reductions shown for 2007 reflect the initial implementation of the fuel specifications in the proposal, assuming that the average sulfur content of the fuel will be 0.5 percent. The 2010 and later reductions reflect the use of 0.1 percent sulfur marine gas oil, which is scheduled to be implemented in 2010 subject to the results of a feasibility evaluation required under the proposed regulation. Figure ES-4 provides a graphical depiction of the change in diesel PM emissions expected with implementation of the regulation.

Figure ES-4: Estimated Diesel PM Emissions in 24 nm Zone With and Without the Implementation of the Proposed Regulation



Significant air quality benefits are expected from the proposed regulation. The reductions in diesel PM, NOx and SOx will help improve regional ambient air quality levels of PM and ozone. We also anticipate significant health benefits due to reduced

mortality, incidences of cancer, PM related cardiovascular effects, chronic bronchitis, asthma, and hospital admissions for pneumonia and asthma-related conditions. These directly emitted diesel PM reductions are expected to reduce the number of premature deaths and other non-cancer health effects from air pollution in California. Staff estimates that the implementation of this regulation will avoid between 2007 and 2020 years approximately:

- 520 premature deaths (260 to 810, 95% CI)
- 14,000 asthma attacks (3,400 to 24,000, 95% CI)
- 120,000 work loss days (103,000 to 140,000, 95% CI)
- 650,000 minor restricted activity days (530,000 to 770,000, 95% CI)

With respect to potential cancer risk, ARB staff believes there will be significant reductions in exposures and potential cancer risks to residents that live near ports in California. For example, based on an analysis of the predicted 2008 and 2015 ambient diesel PM levels near the POLA and POLB, we estimate that in 2008 there will be a 70 percent reduction in the population-weighted average risk relative to the predicted risk levels in 2008 from ocean-going vessel auxiliary engine diesel PM emissions and a 78 percent reduction in 2015.

ARB staff has concluded that no significant adverse environmental impacts will occur from implementation of the proposed regulation. There will be no increase in emissions at any of the locations due to this proposed regulation. The locations experiencing the greatest emission reductions will be those areas nearest to the ports.

19. What are the economic impacts of the proposed regulation?

The proposed regulation would directly impact businesses that operate large ocean-going vessels. These businesses would be required to reduce their emissions through the use of marine distillate fuels, or other equally effective emission control strategies. To estimate the costs of the proposed regulation, we assume compliance will occur through the use of marine distillate fuels. We also estimate that about ten percent of vessels will need to make some modifications to be able to use the specified fuels. For example, some vessels would add an additional fuel tank dedicated for the use of marine distillate fuels.

We estimate the total added fuel cost of the proposed regulation to be about \$34 million annually, and about \$38 million in 2010 when the lower sulfur fuel standard is scheduled to be implemented. We also estimate total capital costs of about \$11 to \$18 million for vessel modifications.

The total annual cost and cost-effectiveness of the proposed regulation is estimated in table ES-3 below by assigning all of the cost of the proposed regulation to each pollutant individually. Using this approach, the diesel PM cost-effectiveness would be about \$26-27 per pound of diesel PM reduced. This estimate does not account for the fact that the proposed regulation would also reduce emissions of NOx and SOx. If half

of the compliance costs are attributed to diesel PM reductions, and half to NOx and SOx reductions, the diesel PM cost-effectiveness would be about \$13-14 per pound. Using either approach, these results compare favorably with the cost-effectiveness of other diesel PM regulations adopted by the Board.

Table ES-3: Cost-Effectiveness of the Proposed Regulation*

Year	Total Annual Cost (dollars)	Emission Reductions (tons per year)			Cost-Effectiveness \$/Ton and (\$/pound)		
		NOx	PM	SOx	NOx	PM	SOx
2007 - 2009	38 million	575	730	5,800	66,000 (\$33)	52,000 (\$26)	6,600 (\$3.20)
2010 - 2011	42 million	575	800	7,200	73,000 (\$37)	53,000 (\$27)	5,800 (\$2.90)

*The proposed regulation becomes effective on January 1, 2007. A lower sulfur 0.1 percent marine gas oil is scheduled for implementation on January 1, 2010, subject to review. The emission reductions and costs shown are based on the 2004 emissions inventory to be consistent with other 2004 data used. The emission reductions in 2007 and 2010 will be greater than the emission reduction figures shown.

The cost to individual businesses will vary widely based on factors such as the following:

- number of vessels visiting California ports;
- number of California port visits per vessel;
- power generated by the auxiliary engines;
- whether the vessel is a "diesel-electric" vessel; and
- number of vessels requiring retrofits.

For example, a business that owns a single small cargo vessel that makes a single annual visit to a California port visit may incur an added cost of a couple thousand dollars. On the other hand, a large vessel operator with several vessels making frequent California port visits may incur added fuel costs approaching a million dollars annually.

Table ES-4 below provides a summary of the added costs to a typical company. The added costs are higher for operators of diesel-electric vessels because their engines use more fuel than the auxiliary engines on other vessels, and because they are primarily large cruise vessel companies that make more frequent visits to California ports.

Table ES-4: Estimated Added Fuel Cost to Typical Vessel Operators*

Type of Company	Capital Cost*	Average Added Annual Fuel Cost
Cargo Vessel	\$100,000 per vessel	\$20,000 per company
Passenger Cruise Vessel/Diesel-electric	\$100,000 to \$500,000 per vessel	\$2,000,000 per company

* Most companies will not need to modify their vessels. Average added annual fuel costs are rounded.

We estimate that affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is based on the staff's analysis of the estimated change in "return on owner's equity" (ROE). The analysis found that the overall change in ROE for typical businesses was less than one percent. Generally, a decline of more than ten percent in ROE suggests a significant impact on profitability. In addition, the added costs of the proposed regulation are a small fraction of the overall operating costs of these large vessels.

Another way to analyze the costs of the proposed regulation is to assume all of the added costs are passed on to the customer. Using this type of analysis, we do not expect significant impacts on the customers of oceangoing vessel operators. For example, we estimate that the added costs of the proposed regulation would add about a dollar per container for importers or exporters shipping containerized goods overseas. We estimate that this represents less than one percent of the shipping cost. For passenger cruise ships, we estimate the added cost of the proposed regulation for a typical Los Angeles to Mexico cruise would be about \$8 per passenger, representing about a 2 percent fare increase.

Since the proposal would not significantly alter the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

20. How does the proposed regulation compare to other air quality regulations affecting ocean-going vessel auxiliary engines?

The U.S. EPA and the International Maritime Organization (IMO) have adopted regulations designed to reduce the emissions from these engines. However, these existing regulations will achieve relatively modest diesel PM reductions compared to the proposed regulation. The U.S. EPA and IMO regulations are summarized below in Table ES-5.

Table ES-5: Summary of U.S. EPA and IMO Regulations

Regulation	Description of Regulation	Comparison to the ARB Staff Proposal
IMO Annex VI New Engine Standards	Establishes NOx exhaust standards for new marine engines. Engine manufacturers have complied since 2000.	• Standards do not reduce PM and achieve modest NOx benefits
U.S. EPA 1999 Category 1&2 Engine Rule	Establishes NOx+HC, PM, and CO exhaust standards for new marine engines. Implementation starts in 2007 for most vessel auxiliary engines.	<ul style="list-style-type: none"> • Standards only apply to U.S.-flagged vessels. • Foreign trade exemption is provided that exempts most vessel auxiliary engines • Benefits phase in slowly with vessel turnover
U.S. EPA 2003 Category 3 Engine Rule	Establishes NOx exhaust standards for new marine propulsion engines equivalent to IMO standards. Would apply large "auxiliary" engines on diesel-electric vessels	<ul style="list-style-type: none"> • Standards only apply to U.S. flagged vessels • Eliminates the foreign trade exemption for category 1 & 2 vessels (see above)
Annex VI IMO marine fuel sulfur limit	Establishes a fuel sulfur cap of 4.5 percent.	Very little fuel is available with a sulfur content this high.
EPA Nonroad diesel Rule	Establishes sulfur limits for diesel fuel used in marine applications	Exempts heavy fuel oil, and marine diesel oil.

In addition to the regulations summarized above (which apply to engines operated in the United States), the European Union countries have developed measures that will reduce emissions from oceangoing vessels. In November, 2002, the European Commission adopted a European Union Strategy to reduce atmospheric emissions from seagoing ships. A step toward implementing this strategy is *Directive 2005/33/EC of the European Parliament and Council Modifying Directive 1999/32 as Regards the Sulfur Content of Marine Fuels* (Directive 2005/33/EC). Directive 2005/33/EC enters into force on August 11, 2005, and includes the following provisions:

- A 1.5 percent sulfur limit for marine fuels used by all seagoing vessels in the Baltic Sea starting May 19, 2006, and in the North Sea and English Channel starting in Autumn 2007;
- A 1.5 percent sulfur limit for marine fuels used by passenger vessels on regular services between EU ports, starting May 19, 2006; and
- A 0.1 percent sulfur limit on fuel used by inland vessels and by seagoing ships at berth in EU ports, starting January 1, 2010.

The provision regarding the use 0.1 percent sulfur fuel by seagoing ships at berth is very similar to the staff's proposal. Like the staff's proposal, the EU control measure specifies a 0.1 percent sulfur limit in 2010. However, the staff's proposal extends out 24 nm, while the EU proposal only applies at berth.